Check List the journal of biodiversity data

NOTES ON GEOGRAPHIC DISTRIBUTION

Check List 18 (2): 269–273
https://doi.org/10.15560/18.2.269

PENSOFT

Pedicularis gracilis var. *brunoniana* (Wall. ex Pennell) T. Husain & Arti Garg: first report from Ladakh, Trans-Himalaya, India

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Abstract

We report *Pedicularis gracilis* var. *brunoniana* (Wall. ex Pennell) T. Husain & Arti Garg (Orobanchaceae) for the first time from Ladakh, a region of Trans-Himalaya in India. This variety is most similar to *P. gracilis* var. *macrocarpa* but differs in having out-curved galea, long calyx lobes with hairy margin. Detailed morphological notes along with photographs are provided to validate this report and facilitate the field identification of this taxon. As we observed only small populations of this variety, strategies are likely required for its conservation in this Himalayan region.

Keywords

Biodiversity, biogeography, floristic diversity, Himalaya, taxonomy

Academic editor: Amit Kumar | Received 24 December 2021 | Accepted 4 March 2022 | Published 14 March 2022

Citation: Banoo S, Ganie AH, Khuroo AA (2022) *Pedicularis gracilis* var. *brunoniana* (Wall. ex Pennell) T. Husain & Arti Garg: first report from Ladakh, Trans-Himalaya, India. Check List 18 (2): 269–273. https://doi.org/10.15560/18.2.269

Introduction

The genus *Pedicularis* L., commonly called louseworts, comprise roughly 677 accepted species which occur worldwide (POWO 2021). The genus mostly comprises hemiparasitic herbs with alternate, opposite, whorled pinnatifid or pinnatisect leaves, a tubular calyx, and a highly variable corolla, which is mostly used in taxonomic delimitation. The unique corolla in the genus generally consists of a basal tube and two distal lips: the upper lip called the galea is compressed and hood-shaped, containing stamens and style, and the lower lip called the labium is spreading and with three lobes (Li 1951).

From India, 84 species, including 14 subspecies and nine varieties, have been so far reported (Husain et al. 2010; Garg and Singh 2015; Singh et al. 2016). From Ladakh—a cold-desert region in the Trans-Himalaya—several species of *Pedicularis* have been reported (Dar and Khuroo 2020). During recent botanical surveys in Drass valley in the Kargil district of Ladakh, we collected specimens of an unknown *Pedicularis* taxon. After critical investigation of its morphological characters, the specimens were identified as *Pedicularis gracilis* Wall. ex Benth. var. *brunoniana* (Wall. ex Pennell) T. Husain & Arti Garg (Husain and Garg 2003). Until now, this variety has not been reported from Ladakh. Therefore, we report *P. gracilis* var. *brunoniana* from Ladakh for the first time.

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Methods

The Ladakh region is part of the Trans-Himalaya biogeographic zone (Rodgers and Panwar 1988). This region, which has an area of roughly 60,000 km^2, consists of highly rugged mountain terrain bordering Pakistan in the west and China in the north and east (Dar and Khuroo 2020). Ladakh is near the meeting points of three major floristic regions: the Central Asian Region (almost arid), the Irano-Turanian Region (with winter rains), and the Sino-Himalayan Region (with summer rains).

We used standard methods for the collection, processing, and preparation of herbarium specimens (Bridson and Forman 1998). Voucher specimens have been deposited at the University of Kashmir Herbarium (KASH). We identified our specimens by consulting the relevant literature (Pennell 1943; Husain and Garg 2003). For nomenclature, we followed IPNI (2021). We prepared the distribution map using QGIS (2020). The macro- and micro-morphological characters were photographed by using a Samsung Galaxy S10 mobile phone and a Dino-lite hand-held field microscope.

Results

***Pedicularis gracilis* var. *brunoniana* (Wall. ex Pennell) T. Husain & Arti Garg**

Taiwania 48 (1): 50, fig. 1a, e, i (Husain and Garg 2003).

Figure 1

Materials examined. INDIA – Ladakh • Matayen Drass Kargil; 34°20′32″N, 075°37′00″E; 3737 m a.s.l.; 6 Aug. 2020; 34°21′31″N, 075°36′33″E; 3484 m a.s.l.; 6 Aug. 2020; 34°21′31″N, 075°36′33″E; 3484 m a.s.l.; 8 Aug. 2020; S. Banoo, A.A Khuroo, A.H. Ganie leg.; KASH 46324, 46322, 3484.

Identification. Annual herb, 5.5–40 cm long. Stem solitary to 5-branched, arising from base; densely hyaline pubescent. Both basal and cauline leaves pinnatisect: basal leaves petiolate, 1–4 cm long, and lamina 1–2 cm long with 5–7 pairs pinnae; cauline leaves in 2–4 whorls, each whorl has 3 or 4 leaves; leaf towards base petiolate, 4–20 mm long, and lamina 1.5–2.0 cm in length; pinnae in 6–9 pairs; abaxial surface pubescent along mid-vein and adaxial surface pubescent throughout. Inflorescence racemose, interrupted; spike 4–8 whorled; 4 flowers in each whorl. Flowers complete, bisexual, with short pedicel, 2 mm long, sparsely pubescent; at the time of fruiting, pedicel slightly longer, up to 4 mm, bracteate; bract leaf-like, sessile, 1–20 mm long; abaxial surface of bract pubescent along mid-vein and adaxial surface pubescent throughout; pinnae in 3–6 pairs. Calyx 4–10 mm, 5-lobed (sometimes 6-lobed); calyx tubular, 4–10 mm long, lobes free, 1–4 mm; lobes of unequal length, dentate; margin ciliate or hairy; calyx tube densely pubescent outside, glabrous inside; free dentate lobes sparsely pubescent outside and pubescent inside; calyx tube purple to violet to green, with 10–15 mid-veins. Corolla pinkish purple, labium throat white, 6–10 mm long; galea 6–12 mm long, bent at a right angle, swollen in middle, out-curved with its beak 6 mm; labium 1–1.4 cm long, 3-lobed, median lobe longer than lateral, lateral lobe overlapped, sinus invisible, median lobe orbicular-suborbicular, margin entire, tip rounded. Stamens 4, epipetalous; filaments 1.0–1.7 cm long, glabrous; anther 1.5–2.0 mm long, basifixed versatile, dithecal, dehiscence longitudinal. Carpel monocarpellary, ovary 3.0–4.0 × 1.0–1.5 mm; style 2.0–2.5 cm long, glabrous; stigma globose, protruding out of galea. Fruit capsule, ovoid-lanceolate, 10–12 mm long. Seeds many, ellipsoid-oblong, 1.1–1.5 × 0.4–0.6 mm. (Fig. 1).

Distribution. India (Himachal Pradesh: Moralkhanda; Rakeham; Haripurdhar; Uttarakhand: Kumaon; Garhwal; and now reported in Ladakh: Matayen Drass). Figure 2.

Habitat. Growing in moist alpine meadows.

Phenology. Flowers and fruits from June to September.

Discussion

New distribution records in global biodiversity hotspots, such as the Himalaya, are important in meeting the Wallacean shortfall in biodiversity science (Gulzar et al. 2021). Our new record of *Pedicularis gracilis* var. *brunoniana* is the first for the flora of Ladakh Himalaya.

Pedicularis gracilis Wall. ex Benth. is classified in the *gracilis* series (eFloras.org 2008) and has three subspecies: *P. gracilis* subsp. *gracilis* Wall. ex Benth., *P. gracilis* subsp. *brunoniana* (Wall. ex Pennell) T. Husain & Arti Garg, and *P. gracilis* subsp. *sinensis* P.C. Tsoong. In the *brunoniana* subspecies, two varieties are recognized: *P. gracilis* var. *brunoniana* (Wall. ex Pennell) T. Husain & Arti Garg and *P. gracilis* var. *macrocarpa* (Prain) Husain & Garg. These varieties are distinguished on the basis of variation in the calyx lobes, galea, and bract.

Until now, 19 species including three subspecies and three varieties of genus *Pedicularis* have been reported from Ladakh Himalaya (Stewart 1972; Kachroo et al. 1977; Polunin and Stainton 1984; Dvorsky et al. 2018; Dorjey and Dolma 2021). The *Pedicularis* plants are reported to serve as foraging source for insect pollinator, thereby strengthening the mutualistic interactions between plant and pollinators (Tong and Huang 2018), which highlights their critical role in maintaining ecological and evolutionary processes.

Alpine and cold-desert areas are some of the most crucial biodiversity reservoirs, but the vegetation of these areas is among the least investigated (Andrea et al. 2009; Cannone et al. 2007). Our new record of *P. gracilis* var. *brunoniana* was collected from a natural population in the interior valley of Matayen, Drass District of Kargil, Ladakh. We located only one population of this taxon in the entire area of our study with only about 40 individuals in two patches about 5 m apart. We found the

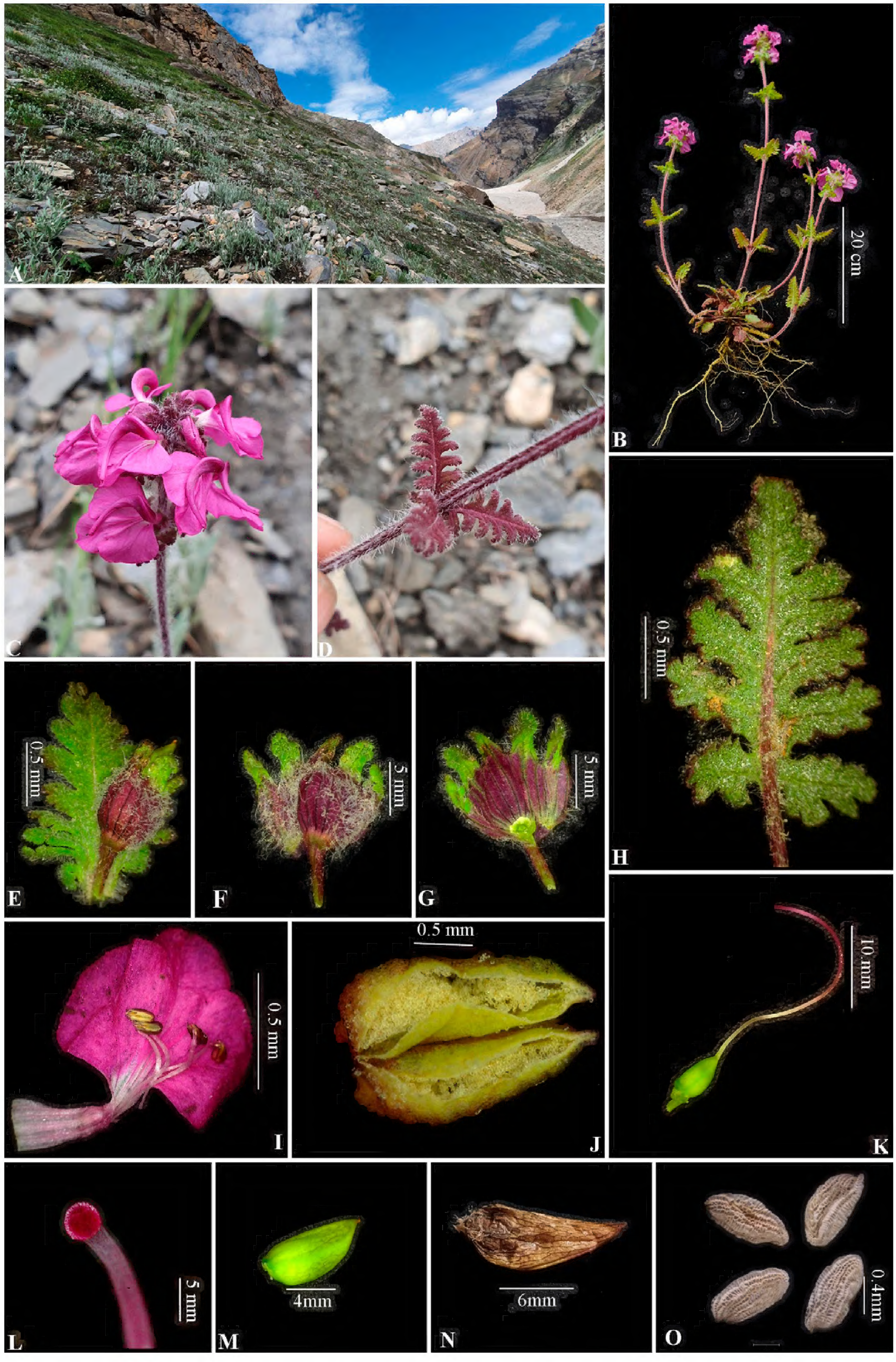

Figure 1. *Pedicularis gracilis* var. *brunoniana* (Wall. ex Pennell) T. Husain & Arti Garg. **A.** Habitat. **B.** Habit. **C.** Inflorescence. **D.** Cauline leaves in whorls. **E.** Adaxial surface of bract. **F.** Abaxial surface of calyx. **G.** Adaxial surface of calyx. **H.** Abaxial surface of bract. **I.** Lobes of labium. **J.** Anther showing pollen dehiscence. **K.** Ovary and style. **L.** Globose stigma. **M.** Unripe fruit. **N.** Ripe fruit. **O.** Seeds.

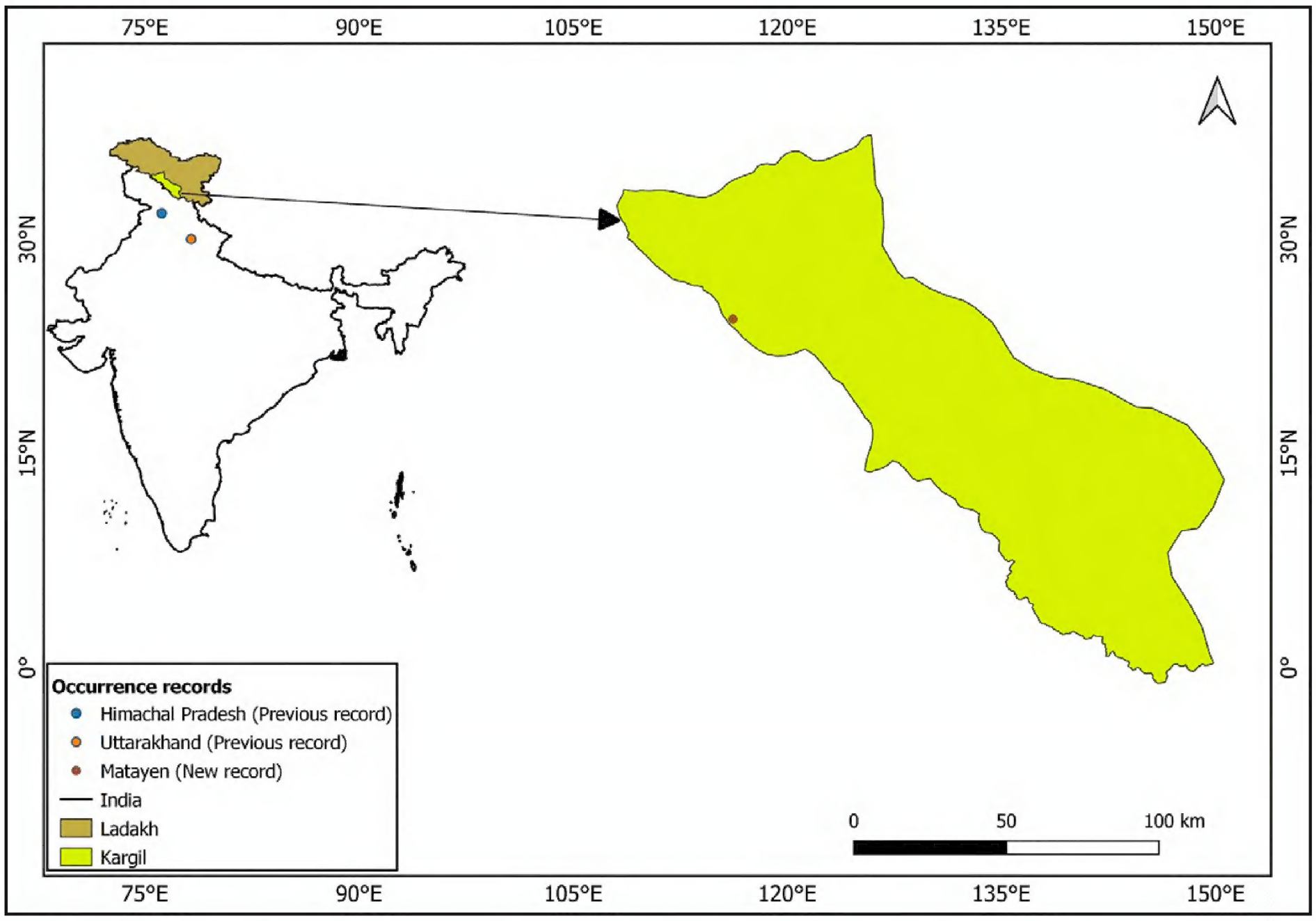

Figure 2. Map showing distribution (previous and new record) of *Pedicularis gracilis* var. *brunoniana*.

heights of plants in this population much reduced, which may be due to high elevation.

In the study area, livestock overgrazing threatens the survival of *P. gracilis* var. *brunoniana*, which has already a small population size. Therefore, seeds from this population could be collected and grown in botanical gardens as an ex-situ conservation strategy.

In traditional medicine of Ladakh, *P. gracilis* is reported to treat various human ailments (Yatoo et al. 2017). *Pedicularis gracilis* contains phytochemicals like tannins, terpenoids, flavonoids, glycosides (Karanjit et al. 2007). The roots are reported to relieve joint pain (Balami 2004).

Acknowledgements

We greatly acknowledge the help provided by the members of BIOTA Laboratory and supporting staff at Centre for Biodiversity and Taxonomy, Department of Botany, University of Kashmir. We are thankful to Sub-District Magistrate, Drass and Forest Department, Kargil, for granting permission to conduct our botanical survey. S. Banoo acknowledges the University Grants Commission (345437), New Delhi, for funding. The reviewers, academic editor and copy editor are also acknowledged for their useful comments, which has improved quality of the manuscript.

Author's Contributions

Conceptualization: AHG, AAK. Data curation: SB. Formal analysis: SB. Funding acquisition: SB. Investigation: AAK. Methodology: AHG, AAK. Resources: AAK. Software: SB. Supervision: AHG, AAK. Validation: AHG, AAK. Visualization: SB. Writing – original draft: SB, AAK. Writing – review and editing: AHG, AAK.

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